ADMINISTRATION AND MANAGEMENT OF SPACE EXPLORATION*

by

James E. Webb
ADMINISTRATOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Exciting new concepts in setting goals, planning programs, and leadership are necessary to attain the objectives of the National Aeronautics and Space Administration.

*Based on an address at the National Conference of the American Society for Public Administration, Detroit, Michigan.

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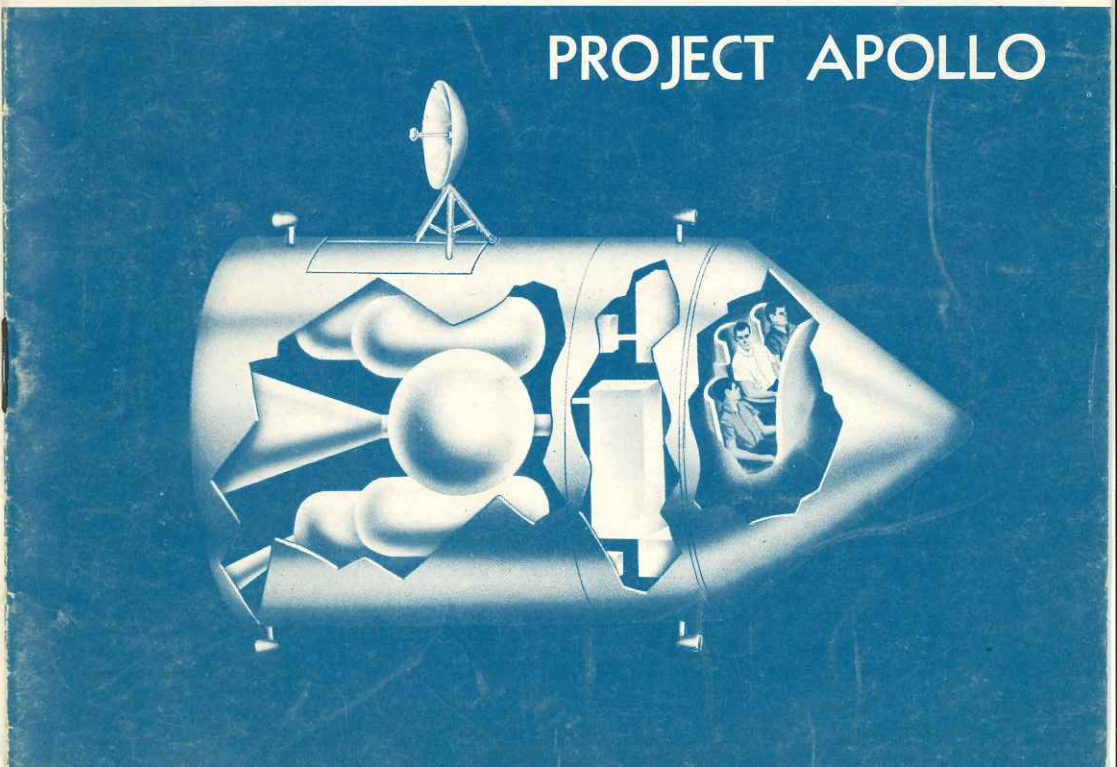


JAMES E. WEBB
ADMINISTRATOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

President Kennedy appointed James Edwin Webb Administrator of the National Aeronautics and Space Administration on February 14, 1961.

Mr. Webb is a member of the Federal Council for Science and Technology, the President's Committee on Equal Opportunity, and the National Aeronautics and Space Council, and is Chairman of the Distinguished Civilian Service Awards Board.

An attorney and businessman, Mr. Webb has served in high governmental and industry positions. He has been active in aviation and education. He is a former Director of the Bureau of the Budget and a former Under Secretary of State. He has been a vice president of the Sperry Gyroscope Co., New York City, chairman of the board of directors of the Republic Supply Co. and a director of Kerr-McGee Oil Industries, Inc.—both with headquarters in Oklahoma City, Oklahoma—and a director of the McDonnell Aircraft Co., St. Louis, Mo.

In private life, Mr. Webb was a member of a number of Government advisory boards, including the President's Committee to Study the U.S. Military Assistance Program—popularly known as the "Draper Committee." He has been engaged in many public service programs related to his long-term interest in science.

Born October 7, 1906, in Granville County, N.C., Mr. Webb graduated in 1928 from the University of North Carolina with a bachelor's degree in education. Later, he studied law at George Washington University, Washington, D.C., and was admitted to the District of Columbia bar in 1936.

In the early 1930's, Mr. Webb became a U.S. Marine Corps Reserve officer and pilot, and he currently holds a commission as a lieutenant colonel in the Marine Corps Reserve.

In 1936, he joined Sperry Gyroscope, serving during 7 years as personnel director, assistant to the president, secretary and treasurer, and vice president.

Mr. Webb became an assistant to the Under Secretary of the Treasury in 1946. Later that year, President Truman appointed him Director of the Bureau of the Budget, a position he held for 3 years. From 1949 to 1952, Mr. Webb served as Under Secretary of State in the Truman administration. From 1953 to 1958, Mr. Webb served as president of the Republic Supply Co. and became chairman of the board in 1958. Between 1952 and 1959, he engaged in a number of business activities, including aircraft manufacturing and accessories, oil equipment and supplies, banking and law.

In 1959, Mr. Webb reduced his activity in business and returned to Washington, where he again devoted much of his time to public service.

Mr. Webb has been awarded the following honorary degrees: LL.D., University of North Carolina, 1949; Syracuse University, 1950; Colorado College, 1957; and George Washington University, June 1961. Sc. D., Notre Dame University, June 1961, and Washington University, St. Louis, February 1962.

ADMINISTRATION AND MANAGEMENT OF SPACE EXPLORATION

ASSIGNMENTS ARE MULTIPLE BUT INTERRELATED

Five Characteristics Distinguish NASA's Assignment

1. *Space research and exploration has multiple and interrelated objectives.* Since the passage of the National Aeronautics and Space Act in 1958, the United States space program has had four general objectives:

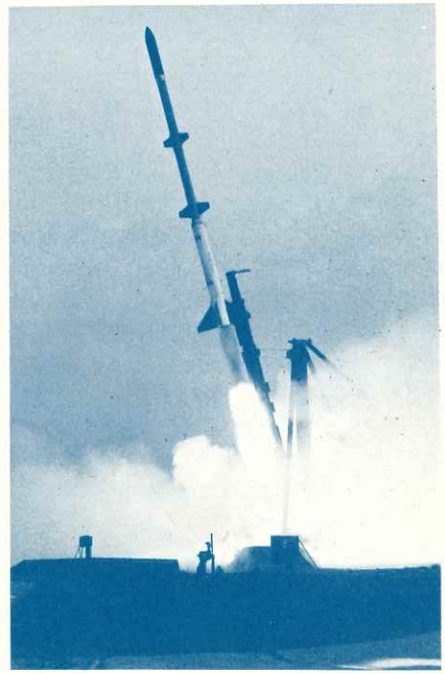
a. To study the space environment by scientific instruments of many types. This involves the use of sounding rockets, earth satellites, and deep space probes;

b. To begin the exploration of space and the solar system by man himself;

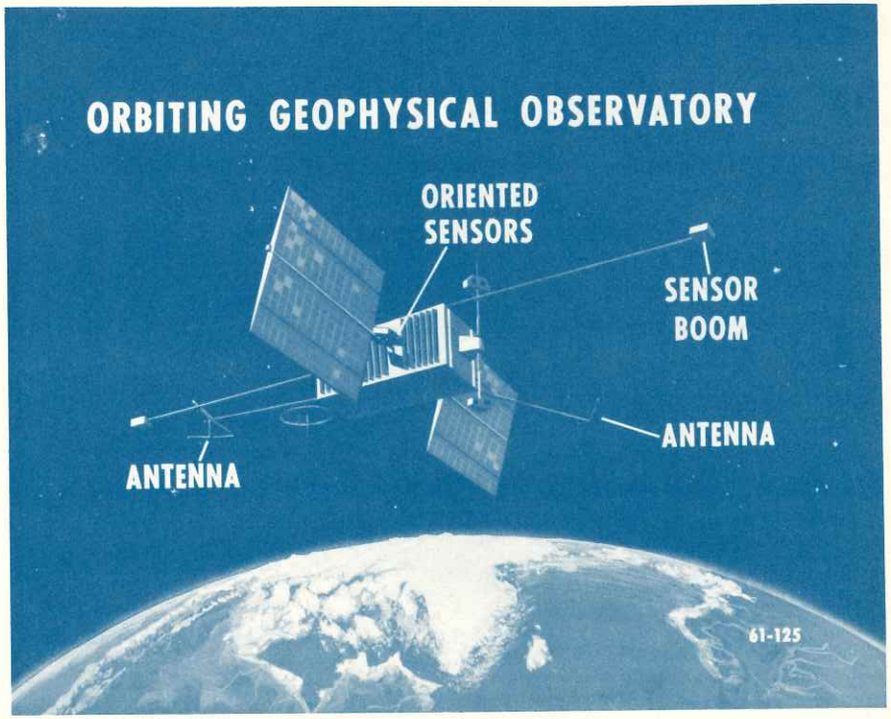
c. To apply space science and technology to the development of earth satellites for peaceful purposes to promote human welfare; and

d. To apply space science and technology in support of military purposes for national defense and welfare.

These objectives are not only multiple, but also closely interrelated. The rapid development of space science and technology is needed to sow seeds for a harvest of future applications. The weather, communications, and navigation satellites of today grew out of the scientific research of the past decades. Findings from space science are directly related to achievement of a manned lunar landing and return. For example, the distribution of harmful radiation in space, the times of their occurrence, whether or not their pres-



". . . sounding rockets . . ."
A four-stage Javelin rocket launched from Wallops Island, Va., in a NASA-Canada project.



". . . earth satellites . . ."
The Orbiting Geophysical Observatory—OGO—for observations of the earth from above the atmosphere.

ence is predictable, and the influence of magnetic fields in space on the radiation hazard, are all important problems that space science investigations must solve before one can safely proceed to send men for substantial periods of time out into space. Similarly, human investigations and exploration of the surface of the moon will provide data needed in the engineering of lunar landing craft and for planning the actual landing operation.

2. *Space research and exploration require a wide variety of skills and a vast accumulation of facilities and equipment.* Representatives from many disciplines, from astronomy to zoology, are required. Facilities running all the way from the 2-million-square-foot Michoud fabrication facilities for the assembly of booster stages to environmental facilities required to simulate the hard vacuum and extreme temperature conditions of outer space are needed. These varying and interrelated requirements for personnel and facilities add a significant dimension to the task of organization and management.

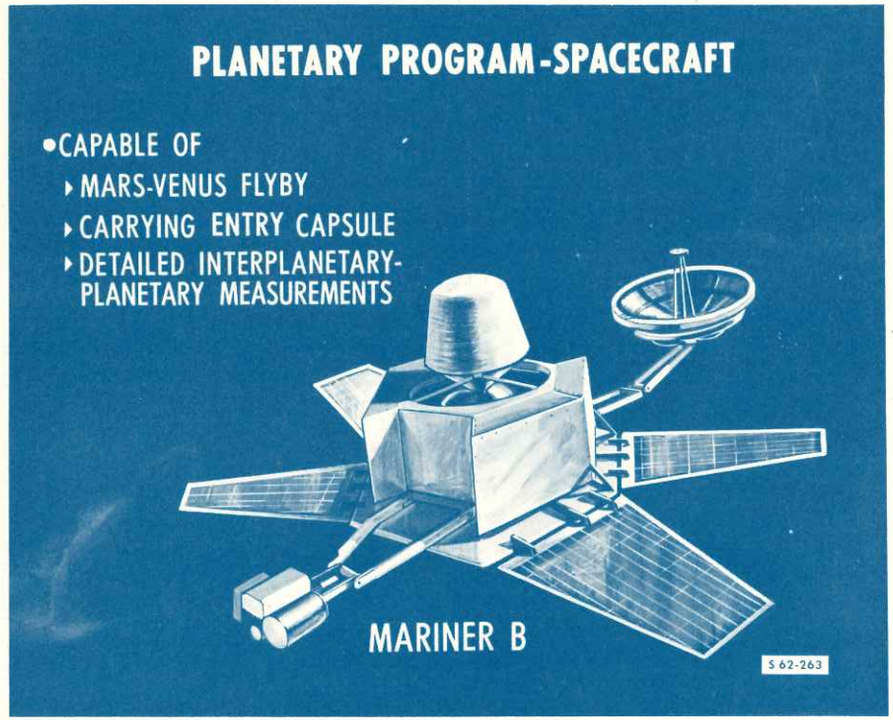
3. *Long lead times, coupled with a rapidly evolving technology, add further complexities to the task of organization of human effort for space exploration.* A long period of years often must elapse from the conception of a new space experiment until the launch vehicle, the payload, and attendant facilities are designed, engineered, built, tested, launched, and the resulting data analyzed. Meanwhile, the discovery of

new knowledge may require substantial alterations. This characteristic of the job places a major emphasis on effectively planning and replanning to assure that what you learn as you go is reflected back into what is going on and what is planned for the future.

4. *A high order of reliability is an absolute necessity.* Cost, the extensive public attention focused on the program, and the risk of human life creates a demand for a degree of reliability seldom required of industrial contractors. The imaginative concepts of the scientists and engineers and the unique equipment which they are developing, necessitates the provision for testing and retesting of ideas and hardware. In addition, this high degree of reliability must be obtained within much tighter time schedules than has historically been the case in complex research and development undertakings.

5. *Space research and exploration must be carried on under the persistent and exacting scrutiny of the public, the Congress, and the scientific community.* Space exploration is and will continue to be front page news. Those who carry on these tasks must be prepared not only to do outstanding work, but also to interpret, explain and defend persistently, what they are doing and why they are doing it.

To bring NASA's organization and management concepts into harmony with these characteristics of the job, has been and will continue to be a major task of NASA management.



". . . and deep space probes."
Mariner B is destined for the long journey to the vicinities of Mars and Venus.

Infusions From Existing Federal Agencies

No new department or agency in the recent history of the executive branch of the Federal Government was created through the transfer of as many units from other departments and agencies as in the case of NASA. Three and one-half years ago, NASA did not exist. Today NASA comprises approximately 20,500 employees, 10 major field centers, and an annual budget approaching the $2 billion mark.

From a purely organizational and managerial point of view, it might have been much easier to create an entirely new department or agency to handle the Nation's civilian space program. This possibility was explored and rejected because of the time required to recruit and organize the technical and scientific talent required.

The principal nucleus of the new agency was the National Advisory Committee for Aeronautics, with a staff of approximately 8,000 employees and an annual budget of approximately $100 million. The NACA laboratories—Lewis, Ames, and Langley—provided NASA with outstanding research capabilities in the field of aeronautics and space. However, this initial nucleus provided insufficient capability to carry out the space flight development and space science functions.

Early organizational thinking envisioned these functions being carried out primarily in one or more decentralized flight development centers. The nucleus of the first such center—the Goddard Space Flight Center—came from the Vanguard and Upper Atmosphere Groups of the Office of Naval Research. At the beginning of calendar year 1959 the Jet Propulsion Laboratory, operated under contract with the California Institute of Technology, was transferred to NASA from the Ordnance Corps of the Department of the Army. This Laboratory comprised some 2,800 employees, constituting another Space Flight Center, with primary capabilities and interests in lunar and interplanetary unmanned research projects.

Concurrently with the transfer of the Jet Propulsion Laboratory, it had been proposed to transfer the Development Operations Division of the Army Ballistic Missiles Agency, headed by Dr. von Braun. This would have provided NASA with a much needed capability in the highly complex area of launch vehicle technology. However, the Department of Defense did not agree to the transfer at the time initially planned. The transfer of Dr. von Braun's group, consisting of 4,600 employees, did not take place until July 1, 1960.

Projects Initiated by Predecessor Agencies

Perhaps as important as the transfer of the various elements from several different agencies—civilian and military—was the fact that almost all of NASA's space flight development and research projects had already been initiated by predecessor agencies. The man-in-space project, Mercury, was initiated by the Langley Research Center of NACA; the Saturn launch vehicle project by the Advanced Research Projects Agency of the Department of Defense, and the Development Operations Division of the Army Ballistic Missiles Agency; the Centaur launch vehicle by the Air Force; and meteorological satellite, Tiros I, by the Army Signal Corps.

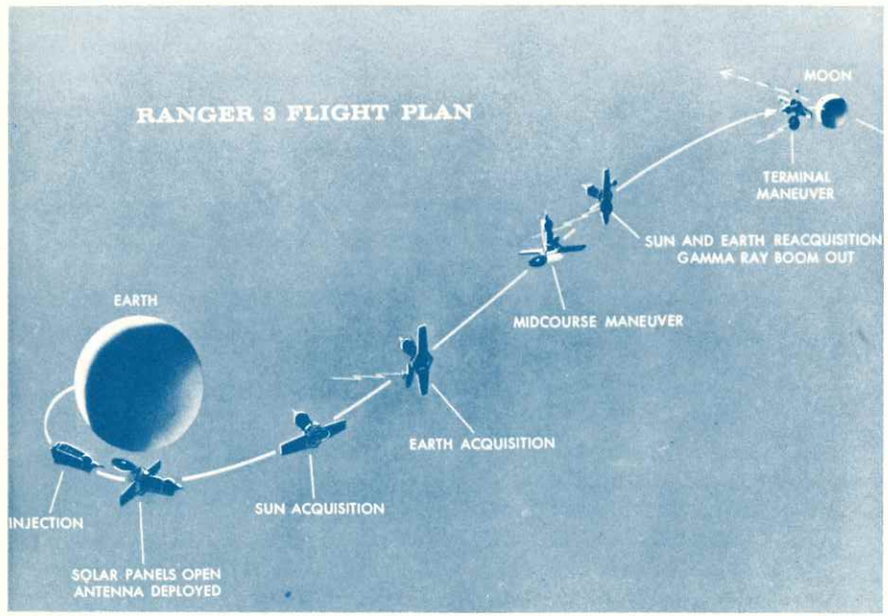
The size and primary capabilities of the units transferred, their varying institutional backgrounds and basic relationships with their parent organization, status and management of the several projects, and similar factors, had a major influence on NASA's initial organization and methods of operation.

Thus, in 3½ years, NASA has grown to an agency of 20,500 employees, exclusive of the 3,200 at the Jet Propulsion Laboratory. Of the total of 20,500 civil servants, approximately 16,000 of these were connected with organizations that were transferred intact to NASA.

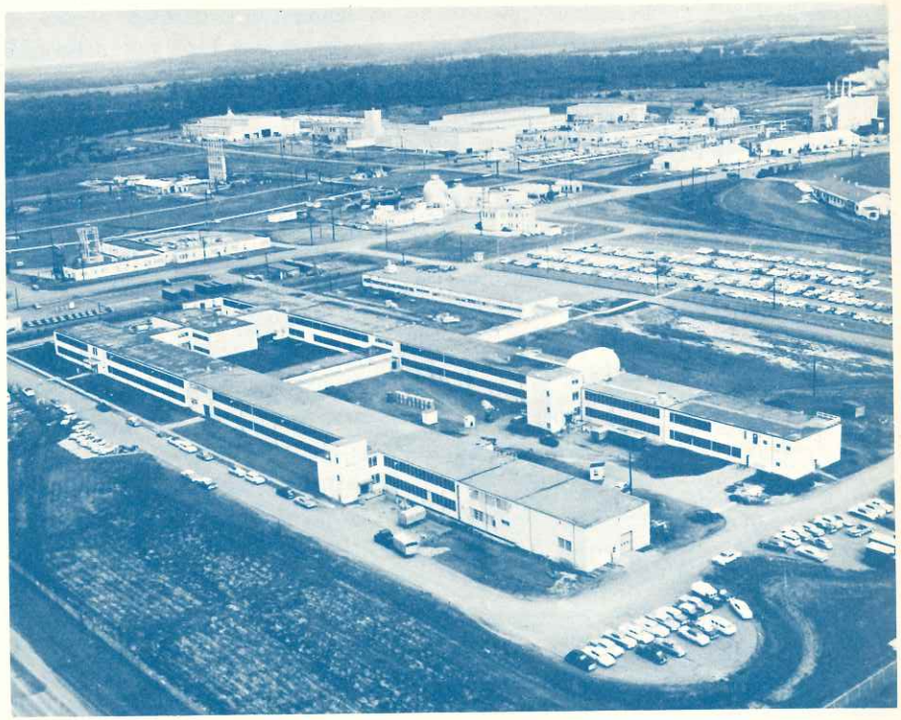
Appropriations for NASA's work have grown from the base of $100 million required by the NACA in 1958 to an amount approaching $2 billion for the fiscal year 1962 and about $3.8 billion for fiscal 1963.

Review and Evaluation of Organization and Management Concepts

As you can well appreciate, in light of the characteristics of NASA's job and the manner in which the agency was created, review and evaluation of the organization structure and management concepts has been a continuous process. This has required a considerable amount of attention and time on the part of NASA's general management since 1958—as it must develop a new organization to undertake such unprecedented tasks. This is particularly true in developing such an organization from the transfer of large elements from other organizations. There can be no doubt that this involves



Ranger, a "rough-landing lunar probe" is a project of the Jet Propulsion Laboratory at Pasadena, Calif.



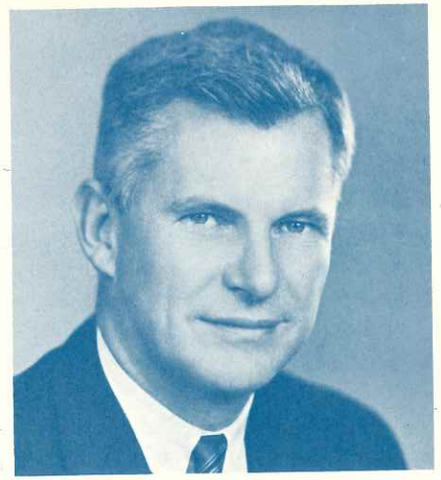
The George C. Marshall Space Flight Center headed by Dr. Wernher von Braun, at Huntsville, Ala.

problems—problems of melding together several groups with different organizational and managerial backgrounds into a coherent, effectively organized, and directed enterprise. The task in this case is also complicated by the emerging fact that traditional government and corporate forms of organization do not really meet today's needs in large technologically based enterprises such as NASA.

NASA's goals and objectives have been spelled out by the President and the Congress about as clearly as those of any Federal department or agency. In addition, my first year as Administrator has convinced me that the transfer of various elements of other departments and agencies has been handled in a highly capable manner, and that this phase in NASA's organizational history is effectively behind us. In this respect, I would like to add this one additional comment. The successful creation of NASA, through the process of the transfer of elements of other departments and agencies, would not have been possible without considerable slippage of on-going work if it had not been for (*a*) the outstanding caliber of the employees transferred; (*b*) the preception and adaptability to change of the various leadership elements; and (*c*) the dedication of both to the tasks in which they were already deeply involved.

Soon after taking office in February 1961, guided by skill and judgment of NASA's Director of Administration, Mr. Albert Siepert, and Mr. John Young, his deputy, steps were initiated by Dr. Hugh Dryden, the Deputy Administrator, Dr. Robert Seamans, the Associate Administrator, and myself, to identify the major organizational and management problems NASA's general management should concern itself with over the near term future. This was little more than another step in the continuous process of review and evaluation that had been initiated by Dr. Keith Glennan, NASA's first Administrator.

Dr. Hugh L. Dryden, Deputy Administrator

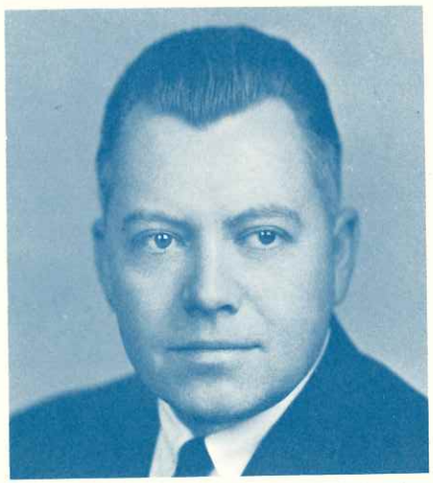


Dr. Robert C. Seamans, Associate Administrator

Expansion of Program by Presidential Direction

Our review and evaluation had gotten to the point where we were considering several evolutionary changes in organizational and management concepts when the President recommended the accelerated and expanded space program. Prior to the President's mes-

Albert F. Siepert, Director of Administration



John D. Young, Deputy Director of Administration

Manned Space Flight Center (artist's conception), Houston, Tex.

steps we would have to take to bring the organization structure, staffing, and management concepts in line with what we anticipated might be a decision to undertake an accelerated and expanded space program. Our study, among other things, included:

1. Setting down a statement of program objectives, major policy assumptions, and management concepts as a basic frame of reference against which NASA's general management might judge various organizational alternatives.

2. We conducted comparative analysis of other experiences, such as the Manhattan Engineering District, Polaris Special Project Office, and Air Force Weapons Systems Management.

3. We developed alternative organizational plans and reviewed these with senior NASA staff and knowledgeable individuals from private life.

After thorough consideration, President Kennedy in May, sent to Congress his recommendation for a program to build the necessary big boosters and step up the program. The Congress completed its authorization of the accelerated and expanded space program in September, 1961. In October we announced the steps we planned to take to bring NASA's organization and management concepts in line with this new program. We began detailed implementation of these steps around November 1 of last year. We are still in this process. As I am sure you can understand, it takes considerable time and effort to implement effectively even relatively small changes in large complex enterprises—private or public. I think you will agree that in few cases has so much effective organizational realinement taken place in so short a time.

Current concepts of organization and management fall logically into five areas:

1. *Headquarters Program Offices* which correspond with each of NASA's four major programs.

2. *Center Directors reporting directly to headquarters general management* on overall Center matters, and to headquarters program directors on program development and execution.

3. *Single focus for tracking and data acquisition* support in headquarters.

4. *Provision for integrated launch operations services* at the Atlantic and Pacific Missile Ranges to serve all NASA projects.

5. *Improved staff services for general management;* that is, an Office of Programs and an Office of Administration at headquarters.

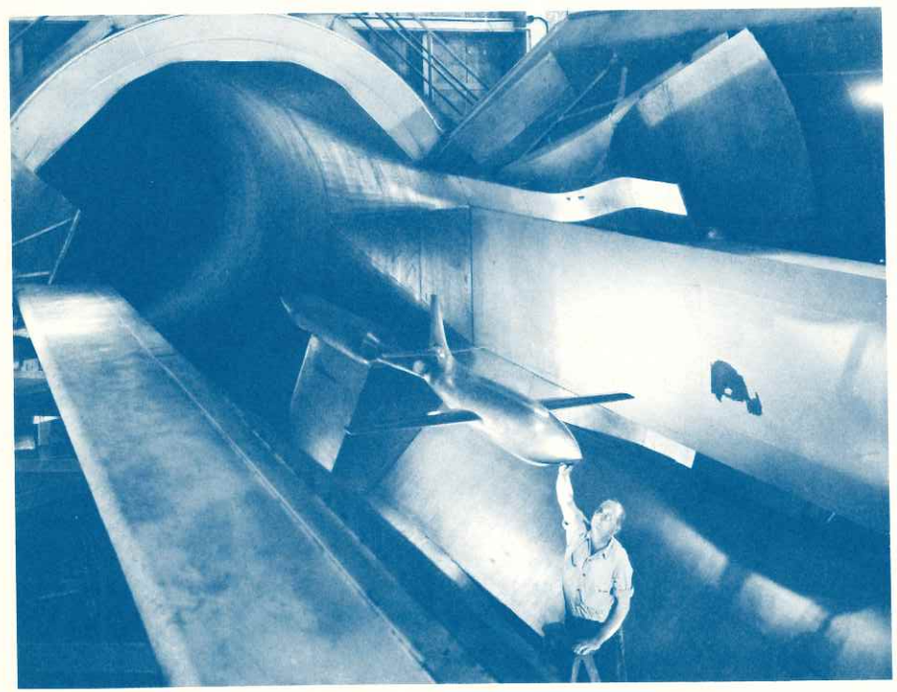
It may be useful to explain in some detail the thinking underlying several of these basic concepts. These are (1) the role of the Headquarters Program Offices; (2) reporting relationships of Center Directors; (3) staff services for general management; and (4) the role of functional managers in the area of administration.

Headquarters Program Directors

Program management in NASA involves the planning and direction of an interrelated series of research and development projects designed to achieve one or more of NASA's major objectives; for example, manned space flight, including a lunar landing and return.

Effective November 1, 1961, the primary responsibility for each of NASA's four major programs—Manned Space Flight, Space Sciences, Application, and Advanced Research and Technology—was assigned to a headquarters program director.

The headquarters program directors are responsible for both staff and line functions. A program director has a

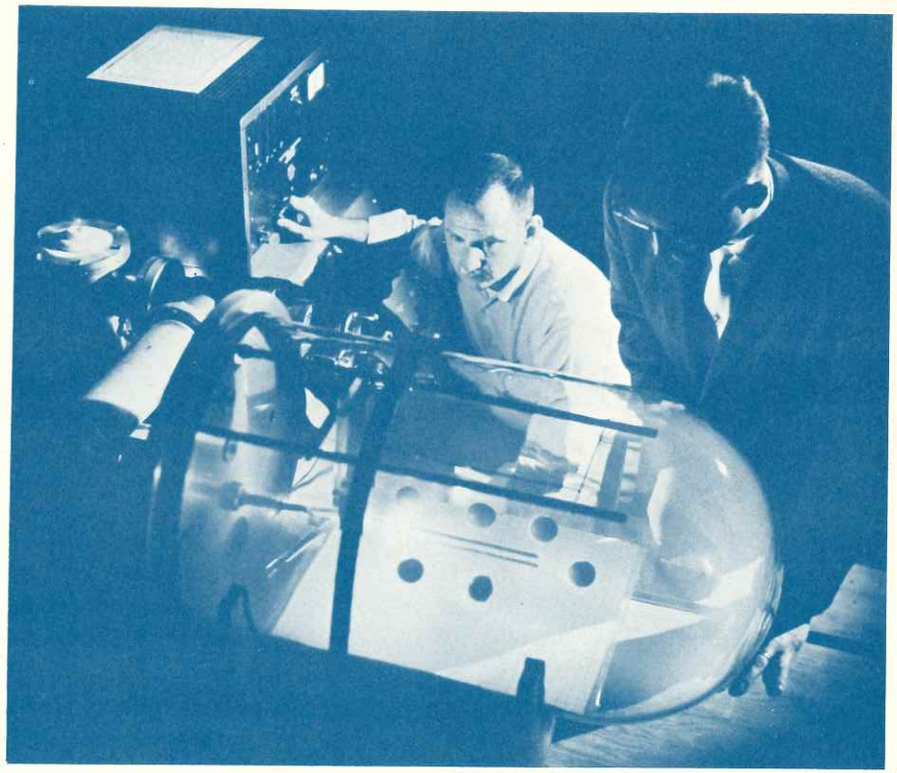


Langley Research Center—the 16-foot transonic wind tunnel.

dual role in which he both advises and operates. He is the principal adviser to the Associate Administrator—NASA's "General Manager"—in regard to his assigned program area. He is also the principal headquarters operating official in regard to management of his assigned program. He directs his assigned program by working directly with Center directors and their project and systems managers. In addition to handling such matters as budgeting and programing of funds and establishing and issuing technical guidelines, each program director is also responsible for providing continuing leadership in external and interagency relationships related to an assigned program.

Reporting Relationships of Center Directors

The reorganization of last November provided that the Directors of NASA's research and development centers report directly to the Associate Administrator—NASA's "General Manager"—rather than a particular technical program office in headquarters as they had up to that time. This was done in recognition that most of the Centers that had been transferred to NASA were multipurpose Centers. Although each had a primary orientation (for example, the Jet Propulsion Laboratory in the area of unmanned spacecraft), most had an across-the-board capability that was important



Lewis Research Center scientists study a prototype plasma rail accelerator, one type of electric rocket engine.

to maintain in terms of rapid feedback from one area to another; for example, from applied research in electronics to the design of particular spacecraft instrumentation, such as Ranger.

We explored the feasibility of (*a*) making NASA's Centers more single purpose and (*b*) more or less completely self-sufficient. Both of these approaches appeared unrealistic in terms of the effective and rapid use of the resources that had been made available to NASA. Thus, it was on basic considerations of that nature that we determined to have NASA's Centers report to the Associate Administrator and contribute to the various programs on the basis of their available inhouse capabilities. This approach also provides opportunities for the Center Directors to have an increased voice in day-to-day policy making and programing decisions.

Staff Services for General Management

During the last year, we have taken steps to improve and strengthen the staff services available to general management. This has been done primarily to provide general management with more accurate, complete, and timely information on which to base program policies and decisions, particularly in terms of insuring that the interrelationships among the four basic programs are continually being properly adjusted.

These staff services are provided by an Office of Programs and an Office of Administration. These offices in reality have multiple bosses. They are responsible for servicing all three members of general management—Administrator, Deputy Administrator, and the Associate Administrator—and the Headquarters Program Directors. This approach helps to minimize the size of headquarters staff services while at the same time obtaining better integration of these services throughout NASA. I must, however, be frank on this point. This approach requires a unique type of individual. Those that are only at ease and secure when they "serve only one boss" are ill adapted to provide effective performance on staffs organized in such a manner.

Role of Functional Managers in the Area of Administration

Here is another area where, I believe, we are departing somewhat from traditional or classical concepts of organization. The directors of divisions, headquarters Office of Administration—for example, the Director of Personnel—are NASA's functional managers and specialists for their particular areas. As functional managers, they are responsible to see that their assigned administrative activities are performed throughout NASA in a manner to accomplish NASA's objectives. Here we are directly and consciously departing from traditional line and staff concepts of organization. Functional management, as we perceive it, is a means of optimizing administrative specialization, while at the same time retaining the essential ingredients of traditional line management concepts. It is an effort to cope with the persistent problems we have in modern complex organizations of solving the dilemma between hierarchy and specialization.

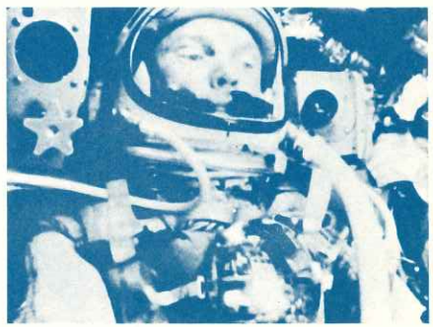
The headquarters division directors, Office of Administration, as functional

Cape Canaveral, Florida—Astronaut John H. Glenn entering the Friendship 7 spacecraft for the first U.S. orbital manned flight, February 20, 1962.

managers, are among other things, responsible for observing and evaluating the manner in which work in his assigned area is carried on throughout NASA. Thus, the division directors share with the Center directors the responsibility for performance of administrative elements within the Center. The administrative elements in the Center do in fact have two bosses. This concept places a premium on competent leadership in the headquarters administrative divisions. There is no escape into the jargon "that I am only a staff man, but they don't take my advice." The functional manager approach places a premium on people who can operate on the basis of competence and confidence in relationship to Center Director and Center administrative elements rather than on traditional authority concepts; i.e., "I have the right to issue directives and you have the obligation to carry them out."

Research for Better Answers in Organization and Management

These, then, are some of the basic concepts that underlie the present organization and management of NASA



Astronaut Glenn photographed in space by an automatic sequence motion picture camera

and the civilian space program. In some areas, we believe we are beginning to plow new ground. However, in light of the unprecedented nature of NASA's job, and its distinctive characteristics, we must do more. We must continually, vigorously, and intelligently seek better answers to the organization and management of a large technological enterprise such as NASA. Some of the major areas of continuing administration present a challenge that we in NASA must address ourselves to in the days ahead. These include:

1. Finding ways of maintaining an imaginative, inquisitive, and open mind on the part of both scientific, technical, and administrative staffs in seeking and implementing viable organizational arrangements and management concepts in keeping with the ever changing nature of the NASA job. I believe to date we have been highly successful in adapting our managerial arrangements to such basic influencing factors as (*a*) the changing nature of the program's objectives and scope as influenced by the results of completed research and development, (*b*) changes in emphasis and timing based on decisions of the President and the Congress, and (*c*) lessons learned from day-to-day management as to the concepts which have worked and those that did not.

As organizations grow to maturity, they have a tendency to become much less flexible in their managerial thinking. To prevent this from happening is a major challenge to general management in technologically based organizations such as NASA, and will present one of the continuing challenges in the administration of the civilian space program.

2. Obtaining a better and broader based understanding of the civilian space program is another significant area of challenge. Here I am particularly concerned with obtaining an understanding of the close complimentary and supporting interrelationships among the four major elements of the civilian space program—manned space flight, space sciences, practical applications, and advanced research and technology. Without adequate understanding and support for the space science and advanced research and technology elements, the other two elements—manned space flight and applications—will not be able to sustain their present rate of progress over the long run. We continually have a tendency to outstrip our reservoir of basic knowledge required for successful manned space flight and applications in such areas as meteorology and communications.

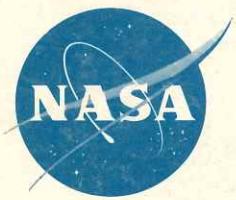
3. A third area of continuing administrative challenge involves obtaining and retaining in the Government laboratories competent scientific and engineering personnel required to plan, select and execute the more important space flight missions and research tasks. This task of making basic determinations of what explorations shall be undertaken and supported at the taxpayers' expense is a governmental function that we do not feel it proper to contract out. In addition, NASA must retain outstanding technical leadership to insure that contractors are provided with sufficiently definitive requirements to submit proposals and produce end items that meet the reliability and schedule requirements of the NASA program. To maintain a high caliber staff in the laboratories means that opportunities must be provided for in-house personnel to personally partici-

pate in a certain amount of the most advanced research and development.

NASA now has these capabilities in terms of the personnel transferred from other elements of the executive branch, and from personnel added to the group from both public and private research and development undertakings. Recruiting efforts for technical and scientific personnel have gone very well. However, we in NASA must be continually alert and imaginative in retaining the type of permissive and intellectual environment that outstanding people require. This, in my judgment, presents a much greater challenge than even that of obtaining an adequate salary structure.

4. The fourth and last area of administrative challenge I would like to touch on briefly, concerns NASA-contractor relationships. Here, I believe, we in NASA, in conjunction with other agencies, such as the Department of Defense and the Atomic Energy Commission, and working with industry must find more effective (*a*) means of selecting research and development contractors, (*b*) evaluating their performance, and (*c*) providing economic incentives based on performance. I am particularly concerned that our present policies and processes unnecessarily require large expenditures of our top scientific and technical personnel, both governmental and industrial, without compensatory advantages.

In summary, I would like to say this. In my judgment, NASA has met forthrightly and in a highly competent manner the administrative challenges involved in the civilian space program to date. To continue to do so, I am convinced, will require even more persistent attention and imaginative effort than has been required so far. I can think of no other area of administration where we need to be more innovative than in the area of the organization and management of large technologically based enterprise—both public and private.



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